# Ec201 Jan 2:1

# Theoretical and Mathematical Ecology

## Instructor

Vishwesha Guttal
Email: guttal@iisc.ac.in

## Teaching Assistant

Jitesh Jhawar, Akanksha Rathore
Email: jiteshjhawar@iisc.ac.in, akankshar@iisc.ac.in

**Department: Centre for Ecological Sciences**

Course Time: Wed 10am - 11:30am, Friday 2pm - 5pm.

Lecture venue: CES Computer Lab

Detailed Course Page: https://teelabiisc.wordpress.com/course-plan-jan-2014/

## Announcements

## Brief description of the course

This is an introductory course in theoretical/mathematical ecology to ecologists/biologists as well as physicists/mathematicians and engineers. At the end of this course, you should develop an ecological intuition that is quantitatively grounded, be able to read and critique mathematical/computational modelling papers, reproduce their results, and possibly even build basic models yourself. This course is also accessible to motivated undergraduate students.

## Prerequisites

Basic calculus and programming

## Syllabus

1) Population dynamics

Discrete population models (Exponential growth; Carrying capacity with logistic model; Cycles, chaos and unpredictability in population dynamics)

Continuous population models (Exponential growth; Carrying capacity with logistic model; Allee effect,

multiple stable states and catastrophic changes)

2) Random walks and stochastic population dynamics

Theory of random walks

Stochastic population models.

3) Evolutionary dynamics

Random walks, drift and diffusion in evolution.

Evolutionary game theory (ESS).

Price equation, altruism and levels of selection.

## Course outcomes

At the end of this course, students should develop an ecological intuition that is quantitatively grounded, be able to read and critique mathematical/computational modelling papers, reproduce their results, and possibly even build basic models themselves. PhD students working in biological research are expected learn to think quantitatively and with a theoretical bent on their own research. This course is also expected to inspire many quantitatively trained UG students towards mathematical biology research.

## Grading policy

1) Assignments (25%): You can expect an assignment on alternate weeks, and a total of about 5 for the entire semester. Due dates will be announced and late submissions will be penalized (20% for not turning in by the precise time; 50% for next day; no credit for any further delays).

2) A mid-term exam (25%): This may be a open-notes or open-book exam.

3) Class participation (25%):  General participation in the class.

4) Final exam 25%. This may be a open-notes or open-book exam.

## Assignments

## Resources

There is no single textbook for this course. But following will be used as references:

1) Intro to mathematics for Life scientists, Batschelet.

2) A Primer of Ecology, Gotelli, 3rd/4th Edition.

3) Mathematical Models of Social Evolution: A guide for the perplexed, McElreath and Boyd

Above references will be kept as reserved in the CES Library (2nd floor of Biological Sciences Building).